

What is Claimed is:

1. A method of processing a substrate having a conductive material layer disposed thereon, comprising:

providing the substrate to a process apparatus comprising a first electrode and a second electrode with the substrate in electrical contact with the second electrode, wherein the substrate surface comprises conductive material layer disposed over narrow feature definitions and wide feature definitions;

supplying a polishing composition between the first electrode and the substrate, wherein the polishing composition comprises:

an acid based electrolyte system;

one or more chelating agents;

greater than about 0.2 wt.% of one or more corrosion inhibitors;

one or more inorganic or organic acid salts;

one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7; and

a solvent, wherein the polishing composition forms a passivation layer on the conductive material;

abrading the passivation layer to expose a portion of the conductive material;

applying a bias between the first electrode and the second electrode; and

removing conductive material disposed over narrow feature definitions at a higher removal rate than conductive material disposed over wide feature definitions.

2. The method of claim 1, further comprising forming a protrusion of conductive material over the wide feature definitions.

3. The method of claim 1, wherein the bias is applied to a substrate at a current density between about 0.01 milliamps/cm² and about 100 milliamps/cm².

4. The method of claim 3, wherein the bias is applied by a pulse modulation technique.

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5. The method of claim 4, wherein the pulse modulation technique and the polishing composition are adapted to form a protrusion of conductive material over the wide feature definition.
6. The method of claim 1, wherein the one or more corrosion inhibitors comprise between greater than about 0.2% and about 1.0% by volume or weight of the composition.
7. The method of claim 2, wherein the protrusion comprises up to about 50% of a thickness of a deposited conductive material.
8. The method of claim 1, wherein the composition further comprises:
 - between about 1% and about 30% by weight (wt.%) of one or more acid based electrolytes in the total volume of solution;
 - between about 0.1% and about 15% by volume or weight of the one or more chelating agents in the total volume of solution;
 - between about 0.1% and about 15% by volume or weight of the one or more inorganic or organic acid salts in the total volume of solution;
 - between about 0.1% and about 25% by volume or weight of the pH adjusting agent in the total volume of solution to establish a pH between greater than about 4.5 and about 7; and
 - the remainder a solvent.
9. The method of claim 8, wherein the composition comprises:
 - about 6% by volume phosphoric acid;
 - about 2% by volume ethylenediamine;
 - about 0.3% by weight benzotriazole;
 - about 2% by weight ammonium citrate;
 - between about 2% and about 6% by volume of potassium hydroxide to provide a pH of about 5; and
 - deionized water.

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10. The method of claim 1, wherein abrading the passivation layer comprises applying a contact pressure between about 0.01 psi and about 1 psi between the substrate and a polishing article and providing relative motion between the substrate and the polishing article.

11. The method of claim 1, further comprising polishing the substrate by at least a chemical mechanical polishing process.

12. The method of claim 11, wherein the at least chemical mechanical polishing process removes conductive material disposed over wide feature definitions at a higher removal rate than conductive material disposed over narrow feature definitions.

13. The method of claim 11, wherein the electrochemical mechanical polishing process is performed on a first platen and the chemical mechanical polishing technique is performed on a second platen.

14. The method of claim 11, wherein the polishing the substrate by at least a chemical mechanical polishing process comprises a second electrochemical mechanical polishing process.

15. The method of claim 14, wherein the first electrochemical mechanical polishing process is performed on a first platen and the second electrochemical mechanical polishing process is performed on a second platen.

16. The method of claim 14, wherein the first electrochemical mechanical polishing process has a composition comprising about 0.3 wt.% of benzotriazole and the second electrochemical mechanical polishing technique has a composition comprising about 0.2 wt.% of benzotriazole.

17. The method of claim 14, wherein the first electrochemical mechanical polishing process has a composition comprising a pH of about 6.5 and the second electrochemical mechanical polishing technique has a composition comprising a pH of about 4.5.

18. A method of processing a substrate having a conductive material layer disposed thereon, comprising:

providing the substrate to a process apparatus comprising a first electrode and a second electrode with the substrate in electrical contact with the second electrode, wherein the conductive material layer is disposed over narrow feature definitions and wide feature definitions;

supplying a polishing composition between the first electrode and the substrate, wherein the polishing composition forms a passivation layer on exposed conductive material;

abrading the passivation layer to expose a portion of the conductive material;
and

applying power by a pulse modulation technique between the first electrode and the second electrode to remove conductive material disposed over narrow feature definitions at a higher removal rate than conductive material disposed over wide feature definitions.

19. The method of claim 18, wherein the pulse modulation technique forms a protrusion between up to about 50% of a thickness of the conductive material over the wide feature definition.

20. The method of claim 18, wherein the pulse modulation technique comprises one or more cycles of applying a power for a limited duration of time and not applying power for a limited period of time.

21. The method of claim 20, wherein the pulse modulation technique applies a power sufficient to provide a current density up to about 100 milliamps/cm².

22. The method of claim 20, wherein the pulse modulation technique comprises one or more cycles of applying a power between about 2 seconds and about 25 seconds and not applying power between about 2 seconds and about 25 seconds.
23. The method of claim 20, wherein the pulse modulation technique comprises applying a power for between about 16% and about 66% of each cycle.
24. The method of claim 18, wherein the polishing composition comprises:
an acid based electrolyte system;
one or more chelating agents;
greater than about 0.2 wt.% of one or more corrosion inhibitors;
one or more inorganic or organic acid salts;
one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7; and
a solvent, wherein the polishing composition forms a passivation layer on exposed conductive material;
25. The method of claim 18, wherein abrading the passivation layer comprises applying a contact pressure between about 0.01 psi and about 1 psi between the substrate and a polishing article and providing relative motion between the substrate and the polishing article.
26. The method of claim 18, further comprising polishing the substrate by at least a chemical mechanical polishing process.
27. The method of claim 26, wherein the at least chemical mechanical polishing process removes conductive material disposed over wide feature definitions at a higher removal rate than conductive material disposed over narrow feature definitions.

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28. The method of claim 26, wherein the electrochemical mechanical polishing process is performed on a first platen and the chemical mechanical polishing technique is performed on a second platen.

29. The method of claim 26, wherein the polishing the substrate by at least a chemical mechanical polishing process comprises a second electrochemical mechanical polishing process.

30. A method of processing a substrate having a conductive material layer disposed thereon over narrow feature definitions and wide feature definitions, comprising:

removing conductive material disposed over narrow feature definitions at a higher removal rate than conductive material disposed over wide feature definitions by an electrochemical mechanical polishing technique; and

removing conductive material disposed over wide feature definitions at a removal rate greater than or equal to the removal rate of conductive material disposed over narrow feature definitions by at least a chemical mechanical polishing technique.

31. The method of claim 30, wherein the at least chemical mechanical polishing technique comprises a second electrochemical mechanical polishing technique.

32. The method of claim 31, wherein the electrochemical mechanical polishing technique comprises a first composition having a first concentration of corrosion inhibitor and the second electrochemical mechanical polishing technique comprises a second composition having a second concentration of corrosion inhibitor less than the first concentration of corrosion inhibitor.

33. The method of claim 32, wherein the first concentration of corrosion inhibitor comprises about 3 wt.% or greater of corrosion inhibitor and the second

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concentration of corrosion inhibitor comprises about less than about 3 wt.% of corrosion inhibitor.

34. The method of claim 32, wherein the corrosion inhibitor has one or more azole groups and is selected from the group consisting of benzotriazole, imidazole, benzimidazole, triazole, and derivatives of benzotriazole, imidazole, benzimidazole, triazole, with hydroxy, amino, imino, carboxy, mercapto, nitro and alkyl substituted groups and combinations thereof.

35. The method of claim 31, wherein the electrochemical mechanical polishing technique comprises a first composition having a first pH and the second electrochemical mechanical polishing technique comprises a second composition having a second pH less than the first pH.

36. The method of claim 35, wherein the first pH is about 6.5 and the second pH is about 4.5.